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AN EVALUATION OF THE MESOAMERICAN SPECIES OF  
*MERIANIA* (MELASTOMATACEAE: MERIANIEAE)

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**ABSTRACT:** *Meriania*, one of 17 genera in the neotropical tribe Meranieae, ranges widely from southern Mexico, Central America, and the Greater Antilles south to the tropical Andes, the Guayana Highland region, and southeastern Brazil. In this study, *Meriania* is reported from Mexico for the first time; a new species, *M. odorata* is described from Costa Rica and Panama; and two species of *Centronia*, *C. grandiflora*, and *C. phlomoides*, are transferred to *Meriania*. This summary of the five Mesoamerican species includes a key, descriptions, geographical and phenological notes, diagnostic illustrations, and citation of representative specimens.

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INTRODUCTION

The genus *Meriania* is a unifying basal group among the 17 genera comprising the Meranieae, a neotropical tribe characterized by prevailing terminal inflorescences, capsular fruits, and oblong-pyramidate, angulate or winged seeds with a smooth or poorly defined surface patterning. With over 50 described species, *Meriania* is the largest genus in the tribe and one of two widespread genera ranging from southern Mexico, Central America, and the Greater Antilles, south through the tropical Andes of South America and east to the Guayana highlands and southeastern Brazil. Preparation of a treatment of the Melastomataceae for Flora Mesoamericana has necessitated an evaluation of *Meriania* and the five other genera of Meranieae reported for the region (Almeda 1981, 1989, 1990; Eves 1936; Gleason 1958; Standley and Williams 1963). Prior to this study, only two species of *Meriania*

were known from Central America based on few collections (Gleason 1958; Standley and Williams 1963).

In this study, the range of *Meriania* is extended to Mexico, a new species is described from Costa Rica and Panama, and the two Central American species previously included in *Centronia* are transferred to *Meriania*. To facilitate recognition and comparison, a regional revision is presented with a key, descriptions, diagnostic illustrations, and citation of representative specimens. All species treated here represent outliers of a genus with major diversity in South America. The five Mesoamerican species can be sorted into three groups based on androecial morphology and details of the indument. Each group appears to have its closest affinities with a different assemblage of South American taxa. A better understanding of species relationships, therefore, must await a comprehensive revision of *Meriania* and its satellite genera.

## SYSTEMATIC TREATMENT

**Meriania** Swartz, Fl. Ind. Occ. 2:823. 1798. (Nom. cons.)

TYPE.—*M. leucantha* (Swartz) Swartz, type cons. [= *Rhexia leucantha* Swartz].

Trees or shrubs with glabrous to variously pubescent distal branchlets. Leaves opposite, decussate, and often long-petiolate, those of a pair equal to somewhat unequal, glabrous to variously pubescent. Flowers typically borne in terminal multiflowered panicles but occasionally solitary, ternate, or verticillate. Hypanthium mostly free from the ovary, campanulate, hemispheric, or urceolate, terete or costate in fruit. Calyx tube usually well-developed, truncate and flangelike, calyx lobes and external teeth obsolete or the calyx deeply lobed with well-developed exterior teeth, or calyx sometimes fused in bud and rupturing irregularly at anthesis. Petals 5 (in our species), free and typically glabrous, obliquely to broadly rounded or truncate at the apex. Stamens 10 (in our species); nearly isomorphic to dimorphic, glabrous, strongly geniculate at the filament insertion; filaments usually declined in one direction transversely across the flower; thecae subulate with a dorsally or ventrally inclined apical pore; connective usually thickened, prolonged, or variously modified dorsally into a dorso-basal spur and an ascending blunt or prolonged dorsal appendage. Ovary superior (3–)5–6-celled, glabrous, the apex prolonged and toothed, truncate, or umbilicate. Style straight, somewhat sigmoid or declinate with a truncate or punctiform stigma. Fruit a many-seeded loculicidal capsule. Seeds narrowly oblong-pyramidal to cuneiform, angulate, truncate to somewhat uncinatate at the wider distal end or with tails at both ends.

Among the 17 genera of Merianieae, *Adelobotrys*, *Axinaea*, *Centronia*, and *Graffenrieda* are close relatives of *Meriania*. There is a particularly close relationship with the *Centronia*/*Graffenrieda* alliance on one hand and a cluster of *Adelobotrys* species on the other. It has even been suggested that the circumscription of *Meriania* could logically be expanded to include these four closely related genera (Wurdack 1973).

As is true of other tribes in the Melastomataceae, the Merianieae exhibit an impressive range of form in calyx structure and anther morphology. It is the spectacular diversity and modifications in these features that pose problems in

fixing generic limits because delimitation of *Meriania* and its satellite genera relies heavily on these characters. A reconsideration of generic limits in the tribe is beyond the scope of this study. Hopefully, new sources of comparative data such as pollen morphology and chromosome numbers will provide information needed to reevaluate relationships among these genera. In the absence of an optimal generic classification of the tribe, *Adelobotrys*, *Axinaea*, *Graffenrieda*, *Meriania*, and the more distantly related *Tessmannianthus* will be recognized in the melastome treatment for Flora Mesoamericana.

The two Mesoamerican species of *Centronia* have androecial morphology and dorsally inclined anther pores like *Meriania* and are here transferred to that genus. They are clearly discordant in *Centronia*, because they do not have arcuate essentially isomorphic anthers with ventrally inclined pores and a connective modified into a solitary acute dorso-basal spur.

Among Mesoamerican genera of Merianieae the only species that could be confused with *Meriania* is *Adelobotrys panamensis* Almeda. This species is similar to some species of *Meriania* in being shrubby or arborescent, lacking malpighiaceae hairs, and in having an anther connective modified dorso-basally into an erect spur and an acute appendage directed more or less parallel to the thecae (Almeda 1981). *Adelobotrys panamensis* is readily distinguished from all species of *Meriania*, however, by its compressed, 2-edged uppermost branchlets and umbelliform pseudolateral inflorescences borne on short stubby branchlets.

KEY TO THE MESOAMERICAN SPECIES OF *MERIANIA*

1. Leaf blades variously pubescent on the abaxial (lower) surface.
2. Abaxial foliar surface covered with shaggy-plumulose hairs and a sparser stellate-hirsute indument between the elevated veins; pedicels and hypanthia copiously pubescent; calyx fused into a bud cap that ruptures irregularly and falls away after anthesis; petals white or greenish-white; stamens nearly isomorphic.
3. Inflorescence a few-flowered panicle with ultimate units consisting of simple cymes or paired or solitary

flowers; floral buds 15–25 × 10–13 mm; petals 2–2.7 × 1.5–3 cm; anther thecae 10–11 mm long; fruiting hypanthia 10–14 × 15–20 mm .....

..... *M. grandiflora*

3. Inflorescence a multiflowered verticillate panicle with ultimate units consisting of fascicled or umbelliform clusters; floral buds 9–13 × 4–7 mm; petals 1.1–1.6 × 0.8–1.3 cm; anther thecae 6.5 mm long; fruiting hypanthia 6–7 × 5–7 mm .....

..... *M. phlomooides*

2. Abaxial foliar surface uniformly covered with a pulverulent or floccose indument; pedicels and hypanthia glabrous; calyx truncate and flangelike with persistent lobes that are ill-defined depressed-ovate undulations; petals magenta; stamens dimorphic .....

..... *M. macrophylla*

1. Leaf blades glabrous on the abaxial surface.

4. Leaves entire; calyx on fruiting hypanthia truncate and flangelike, the lobes obsolete or consisting of ill-defined undulations; petals 1.7–2.5 × 1–1.7 cm; fruiting hypanthia 6–7 × 7 mm .....

..... *M. odorata*

4. Leaves coarsely dentate along the apical half or two-thirds of the blade; calyx on fruiting hypanthia consisting of bluntly rounded or truncate lobes 2–4 mm long; petals 2.6–3.9 × 1.6–3.7 cm; fruiting hypanthia 9–11 × 12–13 mm .....

..... *M. panamensis*

***Meriania grandiflora* (Standl.) Almeda, comb. nov.**

(Figs. 1C, D, E)

*Centronia grandiflora* Standl., Field Mus. Nat. Hist., Bot. Ser. 22:95. 1940. TYPE.—PANAMA. Chiriqui: Bajo Chorro, 2,100 m, 2 Mar 1938 (fl), Davidson 360 (Holotype: F!; isotypes: A!, MO!, US!).

Tree 3–15 m tall. Older cauline internodes ± terete and glabrate; the bluntly quadrate, uppermost branchlets, inflorescence axes, floral buds, and hypanthia moderately to densely covered with brown, basally enlarged hairs (0.5–2 mm long) that are shaggy-plumulose basally but sparingly barbellate to glabrous toward the apex. Leaves of a pair equal to somewhat unequal in size; petioles 2–7.5 cm long and 2–3 mm wide; blades membranaceous when dry, 11.2–21.3 ×

5.5–14 cm, elliptic to elliptic-ovate, (5–)7–9-pinnerved with a well-defined elevated network of secondary and tertiary veins, base obtuse to rounded or varying to obscurely cordate, apex acuminate to attenuate, the margin entire to denticulate, the adaxial surface glabrous and reticulate-bullate, the abaxial surface covered with basally plumulose hairs on the primary and secondary elevated veins and a stellate-hirsute indument between the veins. Inflorescence a terminal few-flowered, openly branched, pedunculate panicle 10–21 cm long, the ultimate units consisting of simple cymes or reduced to paired or solitary flowers; bracteoles 15–30 × 2.5 mm, linear-lanceolate, early deciduous and typically seen only on young inflorescences. Pedicels 9–15 mm long, lengthening to as much as 27 mm in fruit. Hypanthium (at anthesis) hemispheric, 8–12 mm long to the torus. Flower buds rounded-ellipsoid, 15–25 × 10–13 mm, shortly (2–3 mm) blunt-rostrate. Calyx fused in bud but rupturing into irregular rounded-deltoid lobes of varying size that fall away after anthesis. Petals 2–2.7 cm long, 1.5–3 cm wide, white or greenish-white, translucent when fresh, sometimes with darkened conspicuous venation when dry, erect, obovate, ± concave and connivent, rounded to shallowly emarginate apically, the margin entire. Stamens nearly isomorphic, very similar in size but differing slightly in connective modification. Antepetalous stamens: filaments 10–11 mm long, anther thecae 10–11 mm long, white, subulate, horizontal and essentially straight with a dorsally inclined pore; connective thickened, ± flat ventrally but somewhat ridged dorsally along the 2 mm segment prolonged below the thecae, dilated dorso-basally into a divergent longitudinally ridged and adaxially furrowed appendage (4 × 2 mm) and a smaller adjacent spur elevated 1–1.5 mm. Antesepalous stamens: filaments 10–11 mm long, anther thecae 10–11 mm long, otherwise like antepetalous stamens in color, posture, and pore inclination; connective flattened ventrally but vaguely ridged dorsally along the 0.5 mm segment prolonged below the thecae, dilated dorso-basally into an erect compressed, longitudinally ridged appendage (4 × 3 mm) and a smaller adjacent tooth elevated 1 mm. Ovary (at anthesis) ovoid but truncate apically, glabrous, 5–6(–7)-celled, becoming rounded-lobulate to rounded-truncate apically at maturity, superior or adnate to the hypanthium basally for about 3 mm. Style 21–25 mm long, glabrous, erect or slightly

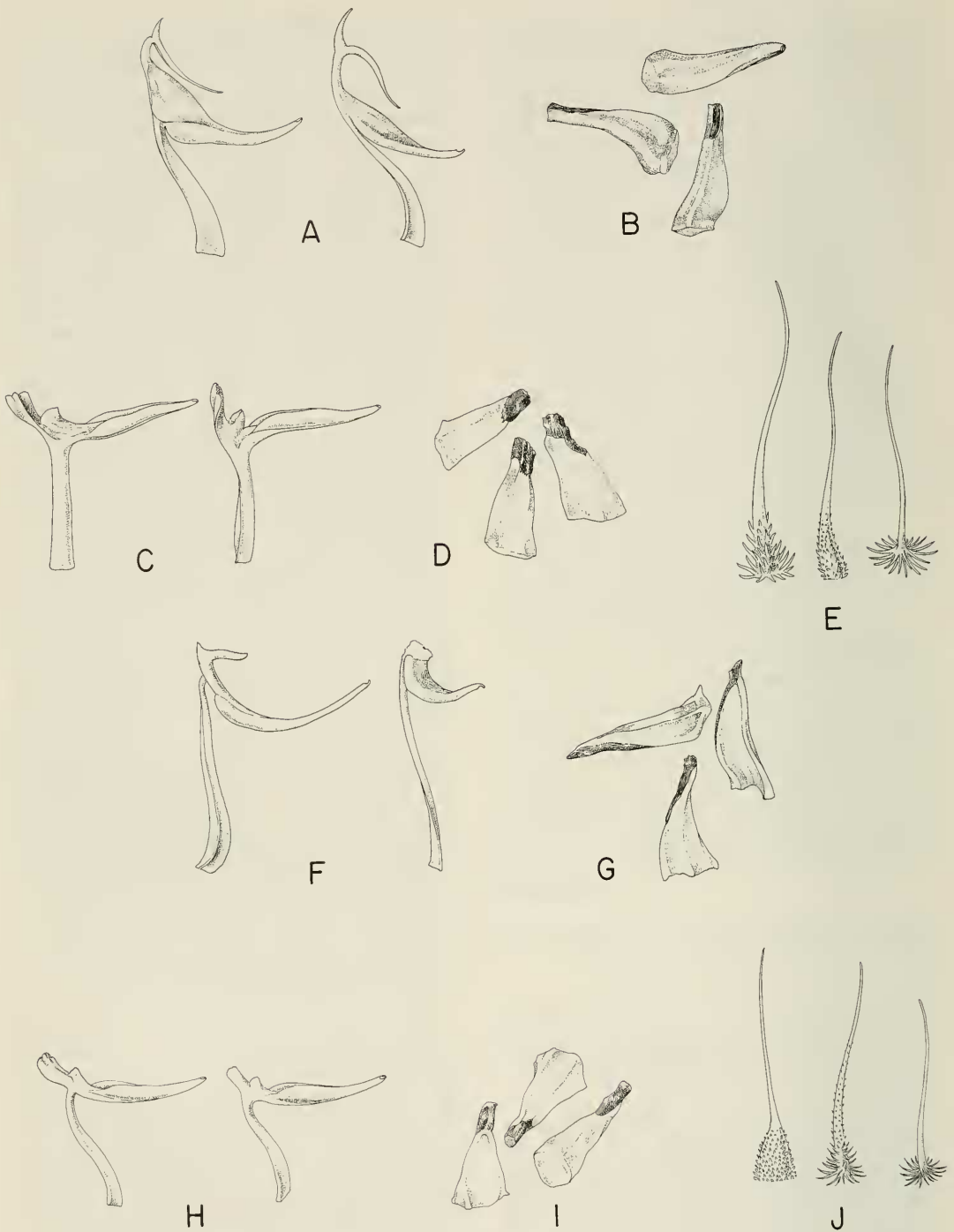


FIGURE 1. Representative stamens, seeds, and hairs of Mesoamerican *Meriania*. *Meriania macrophylla*: A, antepetalous stamen (left) and antesepalous stamen (right),  $\times$  ca. 3; B, seeds,  $\times$  15. *M. grandiflora*: C, antepetalous stamen (left) and antesepalous stamen (right),  $\times$  1 1/2; D, seeds,  $\times$  ca. 13; E, shaggy-plumulose hair (left) of branchlets, inflorescences, and hypanthia, shaggy hair (middle) of abaxial primary and secondary foliar veins, and stellate-hirsute hair (right) of abaxial foliar surface,  $\times$  15. *M. panamensis*: F, antepetalous stamen (left) and antesepalous stamen (right),  $\times$  ca. 2; G, seeds,  $\times$  ca. 9. *M.*



declinate and gently curved apically below the truncate stigma. Fruiting hypanthium campanulate, terete or irregularly rugose or bullate, 10–14 × 15–20 mm. Seeds brown to beige, cuneiform or oblong-pyramidal and angulate, 0.5–1 mm long.

**DISTRIBUTION AND PHENOLOGY.**—Endemic to Panama where it is local in cloud forests at (880)1,350–2,500 m. Flowering collections have been made from January through August; fruiting specimens have been collected in all months except March, April, June, and December.

**REPRESENTATIVE SPECIMENS EXAMINED.**—PANAMA. **Bocas del Toro:** Robalo trail, N slopes of Cerro Horqueta, 5–7 Aug 1947 (fl, fr), *Allen 4992* (MO, NY); E slope of La Zorra to divide on Chiriquí trail, 20 Apr 1968 (fl), *Kirkbride & Duke 833* (NY). **Chiriquí:** vicinity of Cerro Punta, 24 May 1946 (fl), *Allen 3492* (BM, BR, G, NY); 1–2 km N of Las Nubes and 5 km NW of Cerro Punta, 28 May 1972 (fl), *Almeda & Wilbur 1537* (DUKE, MO); trail to Cerro Pate Macho, 8°49'N, 82°24'W, 13 Mar 1988 (fl), *Almeda et al.* 6140 (CAS, MO, PMA, TEX); Monte Azul, 1.4 mi N of Entre Rios on E slopes of Cerro Punta, 22 Nov 1979 (fr), *Antonio 2702* (CAS); vicinity of Las Nubes, 2.7 mi NW of Río Chiriquí Viejo, 27 Feb 1973 (fl), *Croat 22397* (C, F, MO, NY); Bajo Chorro, Boquete district, 25 Jan 1938 (fr), *Davidson 212* (A, F, MO); Guadalupe Arriba, above Cerro Punta, 8°52'N, 82°33'W, 23 Jul 1985 (fl), *de Nevers & Charnley 6055* (CAS); E of Guadalupe along Río Chiriquí Viejo, 2 mi NE of Cerro Punta, 13 Jan 1971 (fl), *Wilbur et al.* 13093 (CAS, DUKE); slopes above Río Caldera beyond Bajo Mono, 17 Jan 1970 (fl), *Wilbur et al.* 11082 (DUKE, F, GH, MO); vicinity of Bajo Chorro, 20–22 Jul 1940 (fl, fr), *Woodson & Schery 6574* (NY). **Coclé:** Cerro Pilon, spring 1968 (fr), *Lallathin 9* (NY).

*Meriania grandiflora* and its close relative, *M. phlomoides*, differ from other Mesoamerican congeners in androecial morphology and complexity of the indument. The upper branchlets, inflorescences, floral buds, and hypanthia of these species are covered with hairs that are here described as shaggy-plumulose. These hairs have an enlarged roughened or shaggy base (Figs. 1E, 1J) and a smooth tapering shaft. The elevated primary and secondary veins on abaxial foliar surfaces of these species are also covered with similar hairs but the base of each is not as prominently expanded and the roughening often extends for a greater distance up the hair shaft. The

hair covering between the veins on abaxial leaf surfaces is stellate-hirsute. I follow Gleason (1940: 339) in using this term for straight or curved essentially smooth, simple hairs with a base that is more or less stellate with numerous radiating arms. (Figs. 1E, 1J). For scanning electron micrographs of comparable hairs see Wurdack (1986:53).

The stamens of *M. grandiflora* and *M. phlomoides* are also noteworthy in having a pseudo-inversion of the connective that was first noted for other species of *Meriania* by Triana (1871: 165). In each stamen the two anther cells are completely separated by the thickened connective. The anther cells are not only separated but strongly positioned upward toward the dorsal appendage-bearing side (Figs. 1C, 1H). This inverted posture of the anther cells superficially makes the dorsal side appear as though it is ventral.

Gleason (1958) erroneously applied the name *Centronia tomentosa* Cogn. to this species and relegated *C. grandiflora* (= *M. grandiflora*) to its synonymy. Wurdack (1976) subsequently transferred *C. tomentosa* to *Meriania* and correctly noted that these two species are not conspecific (Wurdack 1980). Among South American species of *Meriania*, *M. tomentosa* resembles *M. grandiflora* in having an irregularly rupturing dehiscent calyx, and anther thecae that show the pseudo-inversion described above. It consistently differs from *M. grandiflora* in having orange-red petals, yellow anther thecae, larger seeds (1.5 mm) with an elongate lateral raphe, and an appressed-setose hypanthial indument of fine hairs with an expanded roughened base and an attenuate cauducous apex.

***Meriania macrophylla* (Benth.) Triana, Trans. Linn. Soc. London 28:66. 1871.**

(Figs. 1A, B)

*Davya macrophylla* Benth., Pl. Hartw. 75. 1841. TYPE.—

GUATEMALA. **Quezaltenango:** Rancho Palo Hueco, *Hartweg s.n.* (Holotype: K!).

*Conostegia excelsa* Pittier, Jour. Wash. Acad. Sci. 14:450. 1924.

*phlomoides*: H, antepetalous stamen (left) and antesealous stamen (right), × ca. 11; I, seeds, × ca. 11; J, shaggy basally enlarged hair (left) of branchlets, inflorescences, and hypanthia, shaggy hair (middle) of abaxial primary and secondary foliar veins, and stellate-hirsute hair (right) of abaxial foliar surface, × ca. 2 1/4. (A from *Breedlove 47700*; B from *Breedlove & Almeda 47727*; C from *Almeda & Wilbur 1537*; D from *Antonio 2702*; E from *Almeda et al.* 6140; F from *Antonio 1040*; G from *Lao 399*; H from *Almeda et al.* 2728; I from *Almeda & Daniel 7076*; J from *Almeda & Nakai 4674*.)

TYPE.—PANAMA. Chiriquí: southern slope of Cerro Horqueta, Pittier 3196 (Holotype: US!; isotype: FI).

Tree 6–21 m tall with terete to bluntly quadrate cauline internodes. Distal branchlets, peduncles and pedicels of the inflorescence, young hypanthia, and abaxial foliar surfaces caducously pulverulent or floccose. Leaves of a pair typically somewhat unequal in size; petioles (2.3–)4–9 cm long and 3.5–6 mm wide; blades coriaceous when dry, 9.8–34 × (5–)10–28 cm, elliptic to elliptic-ovate, sometimes varying to subrotund, 5(–7)-nerved with secondaries also prominent and elevated abaxially, base broadly rounded to cordate and typically subpeltate, apex obtuse to rounded and commonly mucronate, the margin entire, glabrous adaxially at maturity. Inflorescence a terminal, erect, multiflowered panicle mostly 8–30 cm long, the ultimate units consisting of umbelliform or subverticillate clusters; bracts and bracteoles 0.5–2.5 × 0.25–0.5 mm, subulate, sessile, caducous and typically absent at anthesis. Pedicels 4–12 mm long. Hypanthium (at anthesis) campanulate, 4–6 mm long to the torus. Calyx tube (0.5–)1–2 mm long, ascending or spreading and flangelike; calyx lobes evident as ill-defined undulations or depressed-ovate to semicircular, 1–1.5 mm long and 4–5 mm wide basally between sinuses. Petals 1.5–1.8 cm long, 0.9–1.2 cm wide, magenta, glabrous, oblong-ovate, obliquely rounded apically, the margin entire. Stamens dimorphic and geniculate at the point of filament insertion; filaments (6–)7.5–10 mm long, magenta, glabrous and complanate; anther thecae purple, glabrous, strongly subulate, 7 mm long and 1.5–2.5 mm wide with a dorsally inclined apical pore. Connective of the antepetalous thecae prominently thickened dorsally and modified at the filament insertion into an erect, acutely bifid appendage 3 mm long with a forwardly projecting arm 4 mm long and an outwardly projecting arm mostly 2 mm long. Connective of the antesepalous thecae also thickened dorsally and modified into an incurved bifid appendage 4 mm long with each divergent arm typically 1.5–2 mm long. Ovary (at anthesis) subglobose, glabrous, 5-celled, becoming rounded-lobulate and umbilicate apically at maturity, superior or adnate to the hypanthium only basally. Style 16 mm long, glabrous, somewhat declinate and slightly incurved apically just below the truncate stigma. Fruiting hypanthium essentially glabrous, shallowly campanulate to hemi-

spheric, terete to bluntly costate when dry, 6–8 mm long to the torus and 6–7 mm wide. Seeds brown, vernicose, straight to somewhat curved, cuneiform and angulate, 0.5–1.5 mm long.

DISTRIBUTION AND PHENOLOGY.—Local and uncommon from Chiapas, Mexico, and western Guatemala, disjunct to central Costa Rica and western Panama, in montane forests at 1,400–2,600 m. Flowering from September through January and July; fruiting from January through April.

REPRESENTATIVE SAMPLES EXAMINED.—MEXICO. Chiapas: SW slope of Volcán Tacaná above Talquian, 13 Dec 1974 (fl), *Breedlove 42550* (CAS, DS); above Talquian on slopes of Volcán Tacaná, 18 Nov 1988 (fl), *Breedlove 71535* (CAS); SE side of Volcán Tacaná, 23 Nov 1980 (fl), *Breedlove & Almeda 47700* (CAS, TEX); SE side of Volcán Tacaná, municipio of Union Juárez, 23 Nov 1980 (fr), *Breedlove & Almeda 47727* (CAS, TEX). GUATEMALA. San Marcos: Volcán Tajumulco, 8 Apr 1965 (sterile), *Andrie 521* (US); near Aldea Fraternidad, between San Rafael Pie de la Cuesta and Palo Gordo, 10–18 Dec 1963 (fl), *Williams et al. 26200* (F, G, US). COSTA RICA. Cartago: Volcán Turrialba, between Hacienda Volcán and Pueblo Santa Cruz, 14 Oct 1967 (fl), *Maguire & Maguire 61415* (NY, US). Heredia: NW slopes of Volcán Barva near Río San Rafael, 17 Sep 1967 (fl), *Lent 1291* (CR, F, MO). PANAMA. Chiriquí: Monte Rey above Boquete, 21 Jul 1971 (fl), *Croat 15713* (F, MO); Boquete, 20 Mar 1977 (fr), *Folsom 2207* (CAS); N side of Río Caldera between Horqueta and Bajo Mono, 3 Jan 1975 (fl), *Luteyn & Wilbur 4583* (CAS, DUKE, F, MO); valley of Río Chiriquí Viejo, 14 Apr 1938 (fr), *White 79* (MO, NY); slopes above Río Caldera beyond Bajo Mono, 17 Jan 1970 (fl), *Wilbur et al. 11086* (DUKE, GH, LL, MO, NY).

All Mesoamerican populations of this species are assignable to the nominate subspecies that does not occur in South America. The Colombian population of *M. macrophylla*, which is known only from fruiting material, appears to represent an undescribed subspecies whereas the populations known from the northern and southwestern mountains of Venezuela are attributable to subspecies *costanensis* and subspecies *meridensis* respectively (Wurdack, 1978).

Despite its broad but disjunct distribution, subspecies *macrophylla* is rare throughout its known range. Ongoing destruction of its cloud forest habitat presents a serious threat to its survival. Unfortunately, it is not yet known from any protected park or reserve in the Mesoamerican region.

The large, handsome foliage, straight bole with sparingly flaky bark, and showy floriferous panicle make *M. macrophylla* one of the most spectacular arborescent melastomes in the neotropics.



The staminal morphology of this species is extraordinary. The dorsally thickened connective on the antepetalous stamens (Fig. 1A) is especially thick and fleshy but nothing is known about its functional significance, if any, in pollination.

***Meriania odorata* Almeda, sp. nov.**

(Fig. 2)

TYPE.—PANAMA. **Bocas del Toro:** vicinity of Fortuna Dam, along road to Chiriquí Grande, 08°50'N, 82°15'W, ca. 470 m, 6 Sep 1987 (fl), *McPherson 11651* (Holotype: CAS!; isotypes: MO!, PMA!, US!).

Arbor 8–15 m; ramuli rotundato-quadrangulati demum teretes sicut folia inflorescentia hypanthiaque ubique glabri. Petioli 2–5 cm longi; lamina 6.5–25.6 × 4.2–10.8 cm elliptica vel elliptico-ovata apice acuminata basi acuta vel obtusa, 5-nervata, coriacea et integra. Panicula 6–20 cm longa multiflora, flores 5-meri, pedicellis (ad anthesim) 6–9 mm longis. Hypanthium (ad torum) 4–5 mm longum; calyx 1.5 mm longus truncatus, dentibus exterioribus non evolutis. Petala 1.7–2.5 × 1–1.7 cm asymmetrice obovata. Stamina dimorpha glabra; antheris obongo-subulatis poro 0.75–1 mm diam. Stamina maiora; filamenta 9–10 mm longa; antherarum thecae 9–12 × 1.5 mm, poro dorsaliter inclinato; connectivum 0.5 mm longum longatum dente basali 0.5 mm acuto, appendice ascendenti 3 mm longa. Stamina minora: filamenta 13–14 mm longa; antherarum thecae 5 × 1.5 mm, poro ventraliter inclinato; dente basali 0.25 mm longo acuto, appendice ascendenti 1.5–2 mm longa. Ovarium 5-loculare glabrum; semina 2–3 mm longa.

Tree 8–15 m tall, essentially glabrous throughout with rounded-quadrate internodes. Leaves of a pair equal to slightly unequal in size; petioles 2–5 cm long and 2 mm wide; blades coriaceous when dry, 6.5–25.6 × 4.2–10.8 cm, elliptic to elliptic-obovate, 5-nerved with a prominulous network of secondary and higher order veins evident abaxially, base acute to obtuse, apex bluntly acuminate, the margin entire. Inflorescence a terminal multiflowered panicle 6–20 cm long, the ultimate units consisting of umbelliform or verticillate clusters; bracts and bracteoles evidently early caducous and not seen at anthesis. Pedicels 6–9 mm long. Hypanthium (at anthesis) campanulate, 4–5 mm long to the torus. Calyx tube 1.5 mm long, spreading and flangelike; calyx lobes obsolete or consisting of ill-defined depressed undulations on flowering and fruiting hypanthia; calyx teeth obsolete. Petals 1.7–2.5 cm long, 1–1.7 cm wide, pale pink, glabrous, obovate, rounded to obliquely emarginate or irregularly lobulate apically, the margin otherwise entire. Stamens dimorphic and unequal in length with the larger (antepetalous) stamens inserted on the torus opposite the petals and the smaller (ante-

sepalous) stamens inserted opposite the calyx lobes. Antepetalous stamens: filaments 9–10 mm long, anther thecae 9–12 mm long, yellow, linear-subulate and arcuate with a dorsally inclined apical pore, connective prolonged 1 mm below the thecae and dilated dorso-basally into an acute red spur 0.5 mm long and an oblong red appendage 3 mm long directed ± parallel to the thecae. Antesepalous stamens: filaments 13–14 mm long, anther thecae 5 mm long, yellow, subulate, and somewhat rostrate with a ventrally inclined apical pore; connective dilated dorso-basally into an acute red spur 0.25 mm long and a forwardly projecting oblong appendage 1.5–2 mm long. Ovary (at anthesis) subcylindric to narrowly ellipsoid, glabrous, 5-celled, becoming rounded-lobulate and umbilicate apically at maturity, superior. Style 12–14 mm long, glabrous, declinate and hooked apically below the truncate stigma. Fruiting hypanthium glabrous, suburceolate, terete, 6–7 × 7 mm. Seeds dark brown, vernicose, straight or somewhat curved, linear-cuneate with an inflated winglike appendage at the wider end but tapered and ± caudate at the opposite end, 2–3 mm long.

DISTRIBUTION AND PHENOLOGY.—Local and uncommon in montane rainforest from southern Costa Rica (Limón) to western and central Panama at elevations of 470–1,450 m. Flowering in May, July, and September; fruiting in February, May, and December.

PARATYPES.—COSTA RICA. **Limón:** Parque Internacional La Amistad, Fila Tsiurábeta, entre Ríos Urén y Lari, 9°27'30"N, 83°00'00"W, 25 Jul 1989 (fl), *Chacón 288* (CAS, CR, MO). PANAMA. **Chiriquí:** vicinity of Fortuna Dam, 8°45'N, 82°5'W, 15 Dec 1987 (fr), *McPherson 11794* (CAS). **Coclé:** Cerro Gaital, E slope and ridges leading to the summit, 8°40'N, 80°07'W, 24 Feb 1988 (fr), *Almeda et al. 5900* (CAS, CR, MO, PMA, US); hills N of El Valle, E slope and ridges leading to Cerro Gaital, 8°40'N, 80°07'W, 30 May 1982 (fl), *Knapp 5328* (CAS). **Veraguas:** above Santa Fe and above Alto de Piedra, on ridge trail to top of Cerro Tute-Arizona, 8°30'N, 81°10'W, 6 Feb 1988 (fr), *McPherson 12080* (MO).

All but one of the six known collections of this species were made in the last six years. It seems surprising that an arborescent melastome with showy, fragrant flowers should have gone unnoticed for so long. Rainy season flowering and the apparent restriction of *M. odorata* to the wetter, less accessible slopes of the Caribbean drainage in southern Central America account, in part, for the paucity of collections.

The distinctive features of *M. odorata* include

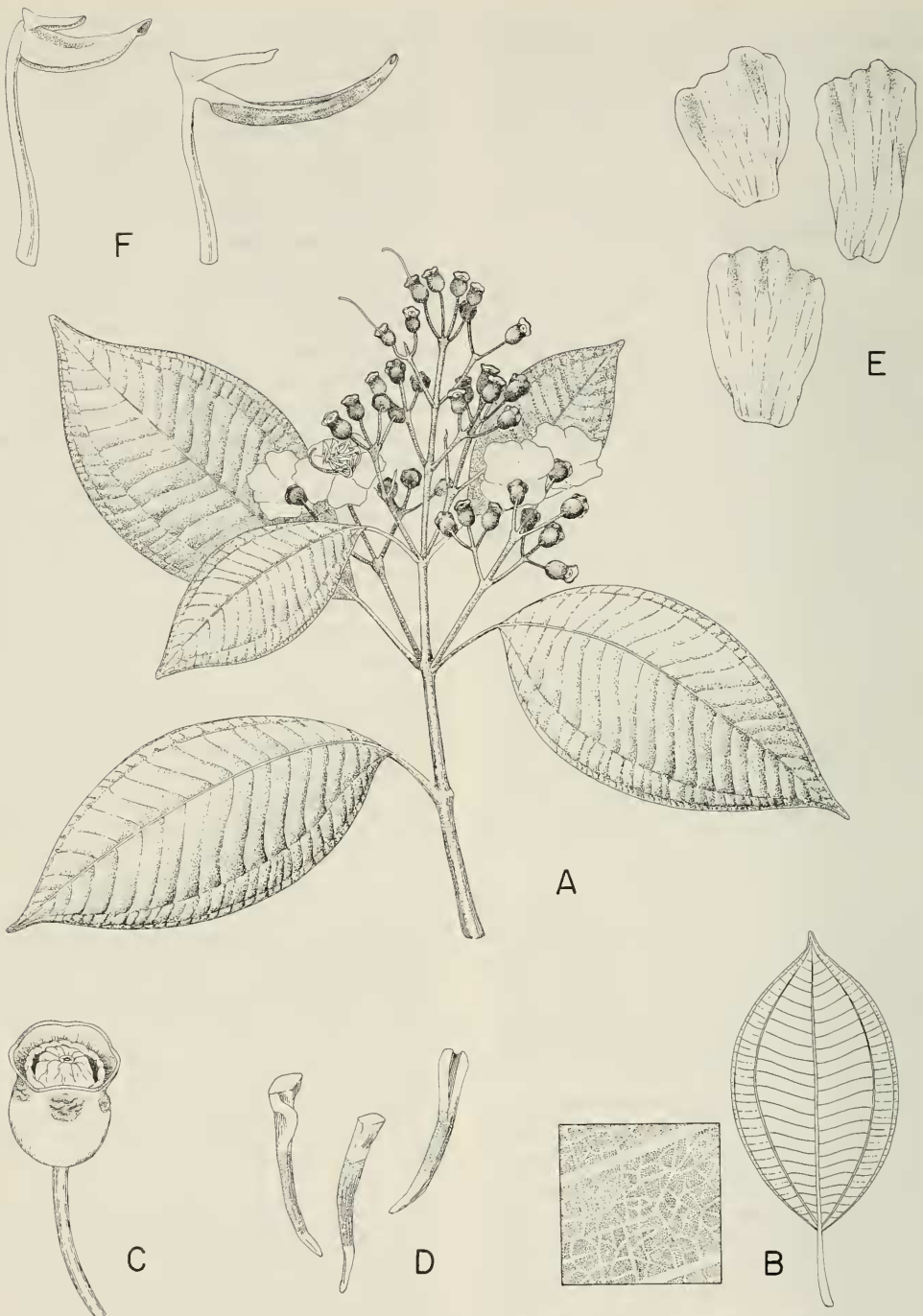


FIGURE 2. *Meriania odorata*. A, habit,  $\times$  ca.  $1/3$ ; B, representative leaf (abaxial surface),  $\times$   $1/4$  with enlargement (left) of area between two transverse secondary veins; C, fruiting hypanthium,  $\times$  2; D, seeds,  $\times$  7; E, petals,  $\times$  1; F, antesepalous stamen (left) and antepetalous stamen (right),  $\times$  ca. 2. (A, B, E, F from the holotype; C from *Knapp 5328*; D from *Almeda et al. 5900*.)



its overall glabrosity, entire leaves, pale pink petals, flangelike calyx with obsolete or ill-defined lobes (Fig. 2C), absence of calyx teeth, and comparatively large, appendaged, linear-cuneate seeds (Fig. 2D).

Among its congeners, *M. odorata* appears to be most closely allied to *M. panamensis*, which is known only from higher elevations (1,850–3,000 m) on the northern slopes of Volcán Barú (= Volcán Chiriquí) in western Panama. Both species are glabrous throughout and share a dimorphic androecium with each set of stamens differing in apical pore orientation (Figs. 1F and 2F). In addition to the diagnostic characters presented in the key, *M. panamensis* also differs in having an ill-defined dorso-basal appendage on the antesealous stamens (Fig. 1F) and markedly different seeds (compare Figs. 1G and 2D).

Label information on *Chacón 288*, *Knapp 5328*, and *McPherson 11651* note that the anthers of this species are yellow. The latter two collectors describe the anthers as yellow and the anther tails as red. I interpret this to mean that the anther thecae are yellow and the appendages are red. If corroborated by additional field observations, coloration of the androecium will provide another difference between *M. odorata* and *M. panamensis*; the latter has magenta anther thecae and yellow appendages.

The epithet for this species is derived from *odorus*, Latin for fragrant or having a smell, to emphasize the rose-scented fragrance of the flowers.

***Meriania panamensis*** Gleason in Woodson and Schery, *Ann. Missouri Bot. Gard.* 28:436. 1941. (Figs. 1F, G)

TYPE.—PANAMA. Chiriquí: Casita Alta to Cerro Copete, Volcán de Chiriquí, 2,300–3,300 m, 10 Jul 1940 (fl, fr), *Woodson & Schery 361* (Holotype: NY!; isotype: MO!).

Tree 4–10 m tall, essentially glabrous throughout with terete internodes. Leaves of a pair equal or only slightly unequal in size; petioles 1.8–4.5 cm long and 1.5–2 mm wide; blades coriaceous when dry, (3.2)7–18.5 × 3.2–8 cm, broadly elliptic varying to elliptic-ovate, 5-nerved with a prominulous network of secondary and higher order veins especially evident abaxially, base acute, apex cuspidate, the margin coarsely and sometimes remotely dentate along the apical half or two-thirds of the blade. Inflorescence a ter-

minial, openly branched multiflowered panicle mostly 9–20 cm long, the ultimate units consisting of simple cymes; bracts and bracteoles 0.3–2.5 cm long and 0.5–5 mm wide, linear-oblong with a cuneate base and rounded apex, the petioles 1–1.5 cm long, early caducous and rarely seen at anthesis. Pedicels 2–5 mm long. Hypanthium (at anthesis) campanulate, 4–7 mm long to the torus. Calyx truncate and flangelike in bud but rupturing (on fruiting hypanthia) into bluntly rounded or truncate lobes 2–4 mm long and 5–7 mm wide basally between sinuses, each calyx lobe inconspicuously beset with a blunt subterminal abaxial tooth or callosity. Petals 2.6–3.9 cm long, 1.6–3.7 cm wide, magenta or violet, glabrous, obovate, rounded to emarginate apically, the margin entire. Stamens dimorphic and unequal in length with the larger (antepetalous) stamens inserted on the torus opposite the petals and the smaller (antesealous) ones inserted opposite the calyx lobes. Antepetalous stamens: filaments 11–12 mm long, anther thecae 10–12 mm long, magenta dorsally and white ventrally, linear-subulate and somewhat arcuate with a dorsally inclined apical pore; connective prolonged below the thecae for 1 mm and dilated dorso-basally into a short acute ± erect yellow spur and a blunt linear-oblong yellow appendage 3–3.5 mm long directed ± parallel to the thecae. Antesealous stamens: filaments 15–16 mm long, anther thecae 6.5–7 mm long, brownish dorsally and white ventrally, subulate with a ventrally inclined apical pore; connective dilated dorso-basally into a yellow erect spur and a forwardly projecting rounded appendage 0.5 mm long. Ovary (at anthesis) ellipsoid, glabrous, (4–)5-celled, becoming rounded-lobulate and umbilicate apically at maturity, superior or adnate to the hypanthium basally for about 1 mm. Style 15–17 mm long, glabrous, somewhat declinate and strongly hooked apically. Fruiting hypanthium glabrous, campanulate, essentially terete or bluntly costate when dry, 9–11 × 12–13 mm. Seeds brown, vernicose, straight or curved, narrowly cuneiform and angulate, tapered to a beak at the wider end when dry, 1–2 mm long.

DISTRIBUTION AND PHENOLOGY.—Known only from western Panama where it is local and uncommon in cloud forests at 1,860–3,000 m. Flowering collections have been made from January through March and in June and September; fruiting specimens have been gathered in January, June, and September.

REPRESENTATIVE SPECIMENS EXAMINED.—PANAMA. Chiriquí: 8 km W of Cerro Punta in vicinity of Las Nubes, 11 Feb 1978 (fl), *Almeda & Nakai 3526* (CAS); Bajo Chorro, E of Cerro Punta, 8°53'N, 82°32'W, 5 Jun 1979 (fl, fr), *Antonio 1040* (CAS, MO); camino de Los Pozos a Cotito y Nueva Zelandia, 13 Mar 1990 (fl), *Aranda et al. 1074* (CAS, PMA); 2.7 mi NW of Río Chiriquí, W of Cerro Punta, 27 Feb 1973 (fl), *Croat 22351* (CAS, MO, NY); Cerro Punta, 14 Sep 1971 (fr), *Lao 399* (MO, US), along road from Cerro Punta towards Boquete near Bajo Grande, 8°50'N, 82°35'W, 5 Jun 1986 (fl), *McPherson 9334* (CAS, MO); above Cerro Punta, 8°50'N, 82°35'W, 9 Feb 1986 (fl), *McPherson & Morello 8380* (CAS, MO); Paseo de Respinga on way to Boquete at top of divide, 14 Jan 1971 (fl), *Wilbur et al. 13196* (DUKE, F, GH, MO, NY).

*Meriania panamensis* is readily recognized even in sterile condition by its glabrous leathery leaves that are coarsely dentate along the apical half or two-thirds of the blade. In addition to the line drawings of stamens and seeds presented here (Figs. 1F, 1G) see Gleason (1958:208) for other illustrations of some diagnostic characters.

See *M. odorata* for a discussion of the probable relationships of *M. panamensis*.

***Meriania phlomoides* (Triana) Almeda, comb. nov.**

(Figs. 1H, I, J)

*Centronia phlomoides* Triana, Trans. Linn. Soc. London 28: 72. 1871.

TYPE.—COSTA RICA, without exact locality, *Oersted 55* (Syn-type: B, destroyed; photographs: CAS!, F, US!). Another syntype, *Hoffmann s.n.*, was cited in the protologue but, to date, I have been unable to locate original or duplicate material of either collection. Oersted's collections from Costa Rica are preserved at Copenhagen (C) but no type material of this species appears to be among them (B. Hansen, in litt., 25 Aug 1988). According to Standley (1937), Carl Hoffmann's collections were at Berlin (B), all of which were evidently destroyed during World War II. I refrain from neotypifying this species pending a more extensive search of European herbaria.

Shrub or tree 2–12 m tall. Older cauline internodes  $\pm$  terete to rounded-quadrate and glabrate, the rounded-quadrate uppermost branchlets, inflorescence axes, pedicels, floral buds, and hypanthia covered with brownish basally enlarged hairs (0.5–1.5 mm long) that are shaggy-plumulose basally but sparingly barbellate to glabrous toward the apex. Leaves of a pair essentially equal to slightly unequal in size; petioles 1.5–1.75 cm long and 1.5–4 mm wide; blades membranaceous when dry, 10.5–26  $\times$  6–15.5 cm, broadly elliptic to elliptic-lanceolate, 5–7-plinerved with a well-defined network of secondary and tertiary veins, base obtuse to rounded or

obscurely cordate, apex acute to short-acuminate, the margin denticulate to subentire, the adaxial surface glabrous but not bullate, the abaxial surface covered with shaggy-plumulose hairs on the primary and secondary elevated veins and a stellate-hirsute indument between the veins. Inflorescence a terminal multiflowered, long-pedunculate (9–17 cm) verticillate panicle (9–)13–21 cm long, the ultimate units appearing fascicled or umbelliform; bracteoles 20–30  $\times$  3–4 mm, linear-lanceolate, early deciduous and usually seen only on young inflorescences. Pedicels 6–12 mm long, lengthening to as much as 23 mm in fruit. Hypanthium (at anthesis) campanulate, 5–6 mm long to the torus. Flower buds rounded-ellipsoid, 9–13  $\times$  4–7 mm, rounded to bluntly acute or bluntly rostrate apically. Calyx fused in bud but rupturing into two irregular rounded-deltoid lobes that fall away after anthesis. Petals 1.1–1.6 cm long, 0.8–1.3 cm wide, greenish-white, somewhat translucent when fresh, the venation darkened and conspicuous when dry, erect, obovate,  $\pm$  concave and connivent, rounded apically, the margin entire. Stamens nearly isomorphic, very similar in size, differing slightly in details of connective modification. Antepetalous stamens: filaments 8–9 mm long, anther thecae 6.5 mm long, white, subulate, horizontal and essentially straight with a dorsally inclined apical pore; connective thickened,  $\pm$  flat ventrally but rounded and somewhat ridged dorsally along the 1 mm segment prolonged below the thecae, dilated dorso-basally into a spreading ridged and adaxially furrowed appendage (2  $\times$  1.5 mm) and a blunt adjacent spur elevated about 0.5 mm. Antesepalous stamens: filaments 7–8 mm long, anther thecae 6–6.5 mm long, otherwise like antepetalous stamens in color, posture, and pore inclination; connective flattened ventrally but somewhat elevated and rounded along the 1 mm segment prolonged below the thecae, dilated dorso-basally into a spreading, flattened, longitudinally ridged appendage (1.5–1.75 mm) and a smaller adjacent tooth elevated 0.5 mm. Ovary (at anthesis) ovoid, glabrous, 5-celled, rounded-lobulate apically, superior. Style 16–17 mm long, glabrous, erect or only slightly declinate and barely curved apically below the truncate stigma. Fruiting hypanthium cupulate, costulate, 6–7  $\times$  5–7 mm. Seeds beige, cuneiform or oblong-pyramidate and angulate, 0.5–1 mm long.

DISTRIBUTION AND PHENOLOGY.—Local and uncommon from northwestern Costa Rica (Cor-



dillera de Tilarán) south through the Cordillera Central to Tapantí and El Empalme on the northern slopes of the Cordillera de Talamanca, disjunct to western Panama and southwestern Colombia (departments of Huila, Nariño, and Valle) at elevations of 900–2,400 m. Flowering and fruiting probably occur sporadically all year but no flowering collections have been seen for January and April, and no fruiting collections have been seen for January, April, and September.

**REPRESENTATIVE SPECIMENS EXAMINED.**—**COSTA RICA.** **Alajuela:** ca. 10 km S of the summit of Volcán Poas, 1 Mar 1981 (fr), *Almeda & Nakai 4674* (CAS, CR); Cerro Pata de Gallo, San Ramón, 6 Sep 1980 (fl), *Gómez-Laurito 5834* (CR); Fila Volcán Viejo, San Carlos, 11–14 Feb 1986 (fr), *Gómez-Laurito 11106* (CR); Volcán Poas, 5 Jun 1966 (fr), *Schnell 759* (CR, F, NY, US); Reserva Forestal de Grecia, orillas del Río Achioté, *Umaña & Campos 46* (CR). **Alajuela/Puntarenas Border:** Cordillera de Tilarán, Monteverde Cloud Forest Reserve, Sendero Brillante along continental divide, 25 Feb 1992 (fr), *Almeda & Daniel 7076* (CAS, CR). **Alajuela/Puntarenas/Guanacaste Border:** Monteverde Reserve, Vert. Pacífico cerca de Ventana, 10 Jun 1976 (fl, fr), *Dryer 810* (CR, F). **Cartago:** 4–6 km N of Trinidad on S facing slopes of Volcán Turrialba, 4 Jul 1977 (fr), *Almeda et al. 2872* (CAS, CR); Reserva de Tapantí, Nov 1982 (fl), *Gómez 18751* (CAS); ca. 6 km SE of Tapantí, near and along crest of ridge S of Alto Patillos, 9°43'N, 83°46.5'W, 9 Oct 1986 (fl), *Grayum & Herrera 7730* (CAS, CR); Cerro Carpintera, Feb 1924 (fr), *Standley 34373* (US); Sendero Palmito, Tapantí, 31 Aug 1989 (fl), *Umaña et al. 379* (CR). **Heredia:** Varablanca, 20 Oct 1971 (fl), *Holdridge 6566* (CR); Cerro de la Cruz, 16 Feb 1972 (fl, fr), *Poveda 380* (CR, MO); Cerro de las Caricias, N of San Isidro, 11 Mar 1926 (fl), *Standley & Valerio 52252* (US). **Heredia/San José Border:** ridge and slopes along Río Para Blancas (Pacific drainage), Cerros de Zurquí, 10°3'N, 84°1'W, 13 Sep 1978 (fl), *Burger & Antonio 11029* (CR). **San José:** Cordillera de Talamanca, ca. 4 km beyond jct. of Interamerican Hwy. and C.R. #222, 19 Dec 1975 (fl, fr), *Almeda 2776* (CAS, CR); 3–6 km beyond Las Nubes near Cascajal on the NW flanks of Volcán Irazú, 10 Dec 1975 (fl, fr), *Almeda et al. 2635* (CAS); La Palma, pass between Volcán Barba and Volcán Irazú, 4 Oct 1968 (fl), *Davidse & Pohl 1283* (CR, F, US); entre La Sierra y El Empalme, 26 Nov 1964 (fl, fr), *Jiménez 2635* (BM, F, G); La Hondura de San José, 15 Aug 1933 (fl, fr), *Valerio 694* (CR, F). **Puntarenas:** Reserva Biológica Monteverde, swamp on continental divide (Sendero Pantanoso) and Sendero Chomogo, 10°18'N, 84°47'W, 16 Jul 1990 (fl), *Haber & Zuchowski 10019* (CAS, CR, MO). **PANAMA.** **Chiriquí:** el camino a Jurutungo, hasta la cima del cerro que esta enfrente, luego que se pasa el río, 15 Mar 1990 (fr), *Aranda & Araúz 1180* (CAS, PMA); camino de Los Pozos a Cotito y Nueva Zelandia, 13 Mar 1990 (fr), *Aranda et al. 1103* (CAS, PMA).

Although local and uncommon like the other four taxa of *Meriania* in Mesoamerica, *M. phlomoides* is the most frequently collected species and the only one with a range extending to southwestern Colombia.

*Meriania phlomoides* and *M. grandiflora* are

often confused because they are so similar in indument details, calyx morphology, petal color, and androecial characters. A collection of *M. grandiflora*, *Woodson & Schery 657*, for example, was the basis for an erroneous report of *M. phlomoides* (as *C. phlomoides*) from Panama (Woodson and Schery 1941). The only authentic Panamanian collections of *M. phlomoides* are the two cited above, which were gathered in 1990.

*Meriania phlomoides* lacks the reticulate-bulbous leaves that are so characteristic of *M. grandiflora* and has a verticillate multiflowered panicle instead of a few-flowered cymose panicle. One of the most striking differences between these two species, however, is simply size. The anther thecae and fruiting hypanthia of *M. grandiflora* are about twice as large as those of *M. phlomoides*. Field experience with these two species indicates that this combination of quantitative and qualitative characters provides an infallible guide to their recognition.

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#### RESUMEN

*Meriania* con más de 50 especies descritas es el género más grande en la tribu neotropical Me-



rianieae. *Meriania* se distribuye desde la parte sur de México continuado a través de Centro América y Las Antillas hasta los Andes, la parte sudeste de Venezuela, y la parte sudeste de Brasil. Los géneros *Meriania*, *Adelobotrys*, *Axinaea*, *Centronia*, y *Graffenrieda* están íntimamente relacionados pero es útil reconocerlos hasta que dispongamos de una monografía de la tribu Merianieae. Se provee una revisión para las especies Mesoamericanas que incluye una clave, descripciones, discusiones, ilustraciones y notas sobre distribución y fenología para todas las especies. Se reconocen cinco especies. Se describe uno nuevo (*M. odorata* de Costa Rica y Panamá) y se transfieren dos especies de *Centronia* a *Meriania*. Estos cambios se basan en características de las anteras.

#### LITERATURE CITED

- ALMEDA, F. 1981. The Mexican and Central American species of *Adelobotrys* (Melastomataceae). *Ann. Missouri Bot. Gard.* 68:204-212.
- . 1989. *Tessmannianthus*, an arborescent genus of Melastomataceae new to Panama. *Ann. Missouri Bot. Gard.* 76:1-6.
- . 1990. A third species of *Tessmannianthus* (Melastomataceae: Merianieae) from Panama. *Brittonia* 42:7-11.
- EVES, D. S. 1936. A revision of the genus *Axinaea* (Melastomataceae). *Bull. Torrey Bot. Club* 63:211-226.
- GLEASON, H. A. 1940. The Melastomataceae of the Yucatan Peninsula. *Carnegie Inst. Wash. Publ.* 522:325-373.
- . 1958. Melastomataceae. Pp. 203-304 in *Flora of Panama*. *Ann. Missouri Bot. Gard.*, Vol. 45. R. E. Woodson, Jr. and R. W. Schery, eds.
- HOLMGREN, P. K., N. H. HOLMGREN, AND L. C. BARNETT, eds. 1990. *Index Herbariorum*. Part I, 8th ed. The herbaria of the world. *Regnum Veg.* 120:1-693.
- STANDLEY, P. C. 1937. Botanical Exploration in Costa Rica. Pp. 45-57 in *Flora of Costa Rica*. *Field Mus. Nat. Hist., Bot. Ser.* 18(1).
- STANDLEY, P. C. AND L. O. WILLIAMS. 1963. Melastomataceae. *Flora of Guatemala*. *Fieldiana Bot.* 24:407-525.
- TRIANA, J. 1871. Les Mélastomacées. *Trans. Linn. Soc. London* 28:1-188.
- WOODSON, R. E., JR. AND R. W. SCHERY. 1941. Contributions toward a Flora of Panama. *Ann. Missouri Bot. Gard.* 28:409-492.
- WURDACK, J. J. 1973. Melastomataceae. Pp. 1-819 in *Flora de Venezuela*, 8. T. Lasser, ed.
- . 1976. Certamen Melastomataceis. XXV. *Phytologia* 35:1-13.
- . 1978. Suplemento a las Melastomaceas de Venezuela. *Acta Bot. Venez.* 13:125-172.
- . 1980. Melastomataceae. Pp. 1-406 in *Flora of Ecuador*, 13. G. Harling and B. Sparre, eds.
- . 1986. Atlas of hairs for neotropical Melastomataceae. *Smithsonian Contr. Bot.* 63:1-80.